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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/772,604	02/05/2004	Jason R. Kolodziej	8540G-000219	5067

27572 7590 05/29/2007
HARNESS, DICKEY & PIERCE, P.L.C.
P.O. BOX 828
BLOOMFIELD HILLS, MI 48303

EXAMINER	
ALEJANDRO, RAYMOND	

ART UNIT	PAPER NUMBER
1745	

MAIL DATE	DELIVERY MODE
05/29/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/772,604	KOLODZIEJ, JASON R.	
	Examiner	Art Unit	
	Raymond Alejandro	1745	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *03/29/07 & 05/07/07*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-26* is/are pending in the application.

4a) Of the above claim(s) *1-9 and 18-22* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *10-17 and 23-26* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 February 2004* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *02/05/04*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of Group II and Species IIA in the replies filed on 03/29/07 and 05/07/07 is acknowledged.

Information Disclosure Statement

2. The information disclosure statement (IDS) submitted on 02/05/07 was considered by the examiner.

Drawings

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: 806. Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 23-25 are rejected under 35 U.S.C. 102(e) as being anticipated by Tate Jr. et al 2005/0057255.

The present application is geared toward a method of operating a fuel cell system wherein the disclosed inventive concept comprises the use of Kalman filter (KF) based processor.

As to claims 23 and 25:

Tate Jr. et al is related to determining states and parameters of an electrochemical cell (P0001) such as fuel cells wherein the state of charge of the electrochemical cell indicates the amount of usable energy stored within the electrochemical cell (P0002). Particularly, in a fuel cell, multiple estimators estimate parameters of the electrochemical cell, the values of the parameters are processed by an estimator to determine properties of the chemical reactions with the fuel cell (P0139). *In this case, the examiner is correlating the amount of usable energy stored within the fuel cell to at least a reactant feed stream such as hydrogen or oxidizing agent such as air.*

Tate Jr. et al disclose methods of estimating a state of charge and state of health of an electrochemical cell including modeling the electrochemical cell with a linear equation (*the mathematical formula*) (ABSTRACT) wherein the step of processing said linear equation

comprises predicting current states based on prior states; predicting current error of said states based on prior errors of said states and determining current state gains based on said current error of said states (CLAIM 7); or predicting current parameters based on prior parameters; predicting current error of said parameters based on prior errors of said parameters; determining current parameters gains based on said current error of said parameters (CLAIM 10).

The linear equation is processed through a Kalman filter (KF) based state and parameter estimator based on terminal current, terminal voltage, temperature and initial states and initial parameters to determine said states and said parameters (CLAIM 13 and 26).

As to claim 24:

The linear equation is processed through a Kalman filter (KF) (CLAIM 13 and 26/P0026, 0034-0035).

Thus, the present claims are anticipated.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 10-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tate Jr. et al in view of Bharadwaj et al 2002/0161550.

As to claim 10:

Tate Jr. et al is related to determining states and parameters of an electrochemical cell (P0001) such as fuel cells wherein the state of charge of the electrochemical cell indicates the amount of usable energy stored within the electrochemical cell (P0002). Particularly, in a fuel cell, multiple estimators estimate parameters of the electrochemical cell, the values of the parameters are processed by an estimator to determine properties of the chemical reactions with the fuel cell (P0139, 0099). *In this case, the examiner is correlating the amount of usable energy stored within the fuel cell to at least a reactant feed stream such as hydrogen or oxidizing agent such as air.*

Tate Jr. et al disclose methods of estimating a state of charge and state of health of an electrochemical cell including modeling the electrochemical cell with a linear equation (*the*

mathematical formula) (ABSTRACT) wherein the step of processing said linear equation comprises predicting current states based on prior states; predicting current error of said states based on prior errors of said states and determining current state gains based on said current error of said states (CLAIM 7); or predicting current parameters based on prior parameters; predicting current error of said parameters based on prior errors of said parameters; determining current parameters gains based on said current error of said parameters (CLAIM 10).

The linear equation is processed through a Kalman filter (KF) based state and parameter estimator based on terminal current, terminal voltage, temperature and initial states and initial parameters to determine said states and said parameters (CLAIM 13 and 26).

As to claim 11:

The 3rd order model of the mathematical formula is considered to be an inherent characteristic of Kalman-filter based state and parameter estimator combining the concept of recursive least squares estimation with a state space model and noise model to optimally estimate a system characteristic, which is based on a liner model or equations (P0026, 0034-0035).

As to claims 12-16:

Disclosed therein is that a previously stored state estimate is updated to determine a present state estimate; and the current state estimate is determined based on the previously stored state estimate (P0051, 0057). The KF equations fall into two groups: time update equations (predictor) and measurement equations (corrector) (P0034). Additionally, the estimator includes six processing models: a synthesis model, a state prediction model, a parameter prediction model, a measurement model, an estimate correction model and an error propagation model (P0038).

Tate Jr. et al disclose methods of estimating a state of charge and state of health of an electrochemical cell including modeling the electrochemical cell with a linear equation (*the mathematical formula*) (ABSTRACT) wherein the step of processing said linear equation comprises predicting current states based on prior states; predicting current error of said states based on prior errors of said states and determining current state gains based on said current error of said states (CLAIM 7); or predicting current parameters based on prior parameters; predicting current error of said parameters based on prior errors of said parameters; determining current parameters gains based on said current error of said parameters (CLAIM 10).

Tate Jr et al disclose a method of operating electrochemical cells such as a fuel cell as described above. However, the preceding prior art reference fails to expressly disclose the specific step of operating a compressor based on KF-based processor.

As to claim 10 and 17:

Bharadwaj et al discloses an apparatus for monitoring the health of a compressor, the apparatus comprises at least one sensor operatively coupled to the compressor for monitoring at least one compressor parameter, and a processor system embodying a Kalman filter, operatively coupled to the at least one sensor, the processor system computing stall precursors, a comparator that compares the stall precursors with predetermined baseline date, and a controller operatively coupled to the comparator, the controller initiating corrective actions to prevent a compressor surge and stall if the precursor deviate from the baseline date representing predetermined level of compressor operability (P0017/ABSTRACT).

In view of the above, it would have been obvious to a person possessing a level of ordinary skill in the art at the time the invention was made to employ the specific step of

operating a compressor based on KF-based processor of Bharadwaj et al in the fuel cell system of Tate Jr et al as Bharadwaj et al disclose that such specific operating step prevents a compressor surge and initiates corrective actions if the compressor deviates from predetermined level of compressor operability. Thus, accurate control of compressor operation is achieved. *In this case, the teachings of Bharadwaj et al are fully relevant to Tate Jr. et al as well as to the field of applicant's endeavor because the two references address the same problem of providing suitable controlling features by employing a KF-based processor or control algorithm.*

10. Claims 10-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tate Jr. et al in view of the European publication EP 0516534 (hereafter the EP'534).

As to claim 10:

Tate Jr. et al is related to determining states and parameters of an electrochemical cell (P0001) such as fuel cells wherein the state of charge of the electrochemical cell indicates the amount of usable energy stored within the electrochemical cell (P0002). Particularly, in a fuel cell, multiple estimators estimate parameters of the electrochemical cell, the values of the parameters are processed by an estimator to determine properties of the chemical reactions with the fuel cell (P0139, 0099). *In this case, the examiner is correlating the amount of usable energy stored within the fuel cell to at least a reactant feed stream such as hydrogen or oxidizing agent such as air.*

Tate Jr. et al disclose methods of estimating a state of charge and state of health of an electrochemical cell including modeling the electrochemical cell with a linear equation (*the mathematical formula*) (ABSTRACT) wherein the step of processing said linear equation

comprises predicting current states based on prior states; predicting current error of said states based on prior errors of said states and determining current state gains based on said current error of said states (CLAIM 7); or predicting current parameters based on prior parameters; predicting current error of said parameters based on prior errors of said parameters; determining current parameters gains based on said current error of said parameters (CLAIM 10).

The linear equation is processed through a Kalman filter (KF) based state and parameter estimator based on terminal current, terminal voltage, temperature and initial states and initial parameters to determine said states and said parameters (CLAIM 13 and 26).

As to claim 11:

The 3rd order model of the mathematical formula is considered to be an inherent characteristic of Kalman-filter based state and parameter estimator combining the concept of recursive least squares estimation with a state space model and noise model to optimally estimate a system characteristic, which is based on a liner model or equations (P0026, 0034-0035).

As to claims 12-16:

Disclosed therein is that a previously stored state estimate is updated to determine a present state estimate; and the current state estimate is determined based on the previously stored state estimate (P0051, 0057). The KF equations fall into two groups: time update equations (predictor) and measurement equations (corrector) (P0034). Additionally, the estimator includes six processing models: a synthesis model, a state prediction model, a parameter prediction model, a measurement model, an estimate correction model and an error propagation model (P0038).

Tate Jr. et al disclose methods of estimating a state of charge and state of health of an electrochemical cell including modeling the electrochemical cell with a linear equation (*the mathematical formula*) (ABSTRACT) wherein the step of processing said linear equation comprises predicting current states based on prior states; predicting current error of said states based on prior errors of said states and determining current state gains based on said current error of said states (CLAIM 7); or predicting current parameters based on prior parameters; predicting current error of said parameters based on prior errors of said parameters; determining current parameters gains based on said current error of said parameters (CLAIM 10).

Tate Jr et al disclose a method of operating electrochemical cells such as a fuel cell as described above. However, the preceding prior art reference fails to expressly disclose the specific step of operating a compressor based on KF-based processor.

As to claim 10 and 17:

The EP'534 discloses monitoring a gas under variable conditions by modeling a gas compressor based on linearized model derived from continuously monitored performance and external parameters (ABSTRACT). The processor delivers a parameter representing the fouling of the compressor to a display through a Kalman filter 38 (ABSTRACT).

In view of the above, it would have been obvious to a person possessing a level of ordinary skill in the art at the time the invention was made to employ the specific step of operating a compressor based on KF-based processor of the EP'534 in the fuel cell system of Tate Jr et al as the EP'534 discloses that such specific operating step assists in providing continuously monitored performance of the compressor for more precise controlling thereof.

Thus, accurate control of compressor operation is achieved. *In this case, the teachings of the EP'534 are fully relevant to Tate Jr. et al as well as to the field of applicant's endeavor because the two references address the same problem of providing suitable controlling features by employing a KF-based processor or control algorithm.*

11. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tate Jr. et al in view of Bharadwaj et al 2002/0161550.

Tate Jr. et al is applied, argued and incorporated herein for the reasons discussed supra. However, the preceding prior art reference does not expressly disclose the specific step of operating a compressor based on KF-based processor.

Bharadwaj et al discloses an apparatus for monitoring the health of a compressor, the apparatus comprises at least one sensor operatively coupled to the compressor for monitoring at least one compressor parameter, and a processor system embodying a Kalman filter, operatively coupled to the at least one sensor, the processor system computing stall precursors, a comparator that compares the stall precursors with predetermined baseline date, and a controller operatively coupled to the comparator, the controller initiating corrective actions to prevent a compressor surge and stall if the precursor deviate from the baseline date representing predetermined level of compressor operability (P0017/ABSTRACT).

In view of the above, it would have been obvious to a person possessing a level of ordinary skill in the art at the time the invention was made to employ the specific step of operating a compressor based on KF-based processor of Bharadwaj et al in the fuel cell system of Tate Jr et al as Bharadwaj et al disclose that such specific operating step prevents a

compressor surge and initiates corrective actions if the compressor deviates from predetermined level of compressor operability. Thus, accurate control of compressor operation is achieved. *In this case, the teachings of Bharadwaj et al are fully relevant to Tate Jr. et al as well as to the field of applicant's endeavor because the two references address the same problem of providing suitable controlling features by employing a KF-based processor or control algorithm.*

12. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tate Jr. et al in view of the European publication EP 0516534 (hereafter the EP'534).

Tate Jr. et al is applied, argued and incorporated herein for the reasons discussed supra. However, the preceding prior art reference does not expressly disclose the specific step of operating a compressor based on KF-based processor.

The EP'534 discloses monitoring a gas under variable conditions by modeling a gas compressor based on linearized model derived from continuously monitored performance and external parameters (ABSTRACT). The processor delivers a parameter representing the fouling of the compressor to a display through a Kalman filter 38 (ABSTRACT).

In view of the above, it would have been obvious to a person possessing a level of ordinary skill in the art at the time the invention was made to employ the specific step of operating a compressor based on KF-based processor of the EP'534 in the fuel cell system of Tate Jr et al as the EP'534 discloses that such specific operating step assists in providing continuously monitored performance of the compressor for more precise controlling thereof. Thus, accurate control of compressor operation is achieved. *In this case, the teachings of the EP'534 are fully relevant to Tate Jr. et al as well as to the field of applicant's endeavor because*

the two references address the same problem of providing suitable controlling features by employing a KF-based processor or control algorithm.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Raymond Alejandro
Primary Examiner
Art Unit 1745

RAYMOND ALEJANDRO
PRIMARY EXAMINER